Table S1. The two-level factorial design in actual level and results.

No.	Glucose	Peptone	$(NH_4)_2SO_4$	Acetic acid	Shaker speed	2,3-BD production
	(g L^{-1})	(g L^{-1})	(g L^{-1})	(g L^{-1})	(rpm)	(g L^{-1})
1	110	13	5	0.8	70	7.20 ± 0.18
2	130	17	5	1.2	90	7.56 ± 0.13
3	130	13	7	1.2	90	6.73 ± 0.09
4	110	13	7	0.8	90	7.49 ± 0.11
5	130	13	7	1.2	70	6.95 ± 0.15
6	110	13	5	1.2	70	6.84 ± 0.18
7	110	17	7	0.8	90	8.75 ± 0.12
8	110	17	7	1.2	70	6.98 ± 0.08
9	130	13	5	0.8	90	8.46 ± 0.17
10	130	17	5	0.8	70	8.46 ± 0.10
11	130	17	7	0.8	70	9.14 ± 0.19
12	110	17	5	1.2	90	7.02 ± 0.07
13	120	15	6	1.0	80	7.42 ± 0.09
14	120	15	6	1.0	80	6.91 ± 0.09
15	120	15	6	1.0	80	7.09 ± 0.12

Table S2. The central composite design (CCD) in actual level and results.

NO.	Glucose	Peptone	Acetic acid	2,3-BD production(g/L)	
	(g L^{-1})	(g L^{-1})	(g L^{-1})	Actual value	Predicted value
1	140	16	0.7	9.60 ± 0.12	8.90
2	140	16	0.8	10.40 ± 0.09	11.09
3	140	24	0.7	12.32 ± 0.13	12.43
4	140	24	0.8	10.76 ± 0.10	10.56
5	150	16	0.7	11.20 ± 0.11	11.24
6	150	16	0.8	10.48 ± 0.14	10.21
7	150	24	0.7	12.28 ± 0.18	12.62
8	150	24	0.8	8.16 ± 0.11	8.71
9	145	20	0.66591	11.64 ± 0.13	11.69
10	145	20	0.83409	9.08 ± 0.13	9.25
11	145	13.2728	0.75	8.80 ± 0.08	9.57
12	145	26.7272	0.75	11.84 ± 0.12	11.29
13	136.591	20	0.75	10.40 ± 0.15	11.09
14	153.409	20	0.75	11.96 ± 0.12	11.49
15	145	20	0.75	13.52 ± 0.11	13.33
16	145	20	0.75	13.00 ± 0.16	13.33
17	145	20	0.75	13.52 ± 0.21	13.33
18	145	20	0.75	13.20 ± 0.15	13.33
19	145	20	0.75	13.44 ± 0.18	13.33

Table S3. Equality of Variances.

Method	*F* ratio	$p > \|F\|$
Folded F	11.1123	0.1869

Table S4. Result of T-test.

	DF	$p > \|F\|$
Variances equal	13	0.2997
Variances unequal	11.51	0.0831

Table S5. Experimental design and results of model validation.

	2,3-BD production (g L^{-1})
Predicted value	13.632
Experimental values	13.408 ± 0.16
	13.492 ± 0.12

	13.644 ± 0.15
	13.636 ± 0.09
	13.516 ± 0.12

3. Results and discussion

3.1. Effects of single-factor on the production of 2,3-BD

The growth curve of *S. cerevisiae* L7 in the fermentation medium was shown in Fig.S1A. The fermentation medium was rich in nutrients and the strain entered the stabilisation phase at 18 h after incubation. In order to optimize the shaking speed for culturing the strain, a higher speed was chosen before the stabilisation phase to allow the accumulation of cells, after that the speed was shifted to a lower speed to reduce the oxygen content in the cultural condition, which was conducive to the production of the target metabolite 2,3-BD produced. The growth of *S. cerevisiae* L7, the production of 2,3-BD and the dynamics of pH in the initial fermentation medium were shown in Fig.S1B and S1C. The strain grew logarithmically in the initial stages of fermentation and entered the stable stage with fermentation progressed, reaching 8.08 ± 0.01 CFU/mL when the fermentation reached 36 h. The strain's growth was accompanied by a decrease in the pH of the fermentation medium, reaching the lowest point (4.05 ± 0.01) at 108 h. In the initial fermentation medium, 2,3-BD was detected at 36 h and reached the maximum production of 2,3-BD (3.69 ± 0.13 g/L) at 72 h. Therefore, the production of 2, 3-BD in the fermentation medium at 72 h was taken as the index to obtain the optimal fermentation conditions in the subsequent study.

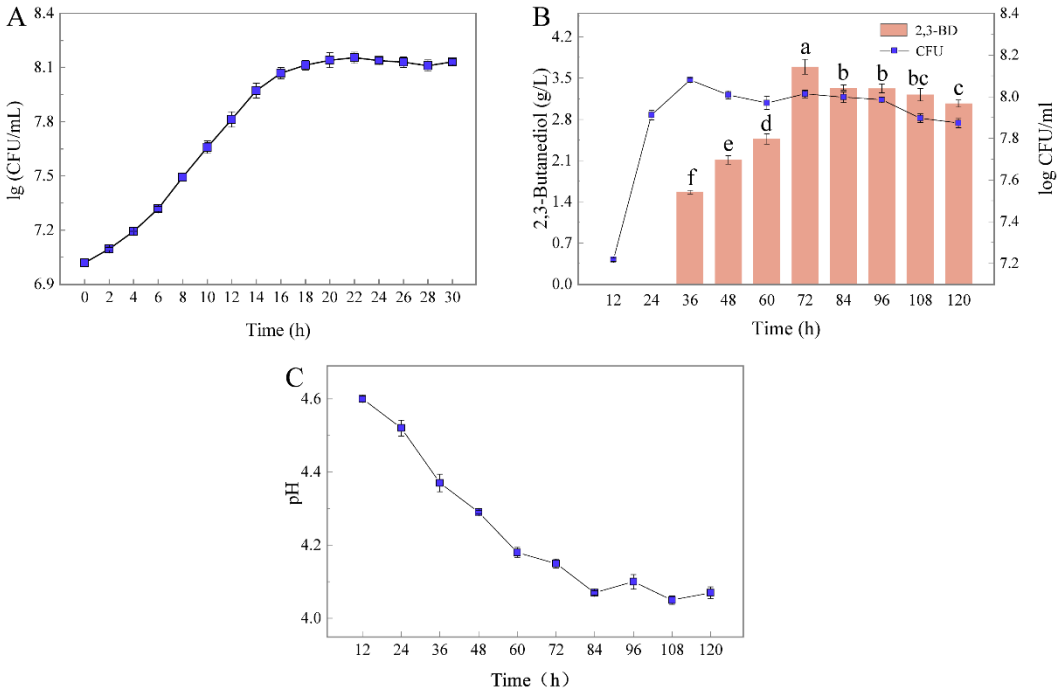


Figure S1. A: The growth curve of *S. cerevisiae* L7 in fermentation medium. B: The dynamic changes of the 2, 3-BD production and the total number of cells in the fermentation medium of *S. cerevisiae* L7. C: The changes of pH value of *S. cerevisiae* L7 in medium.

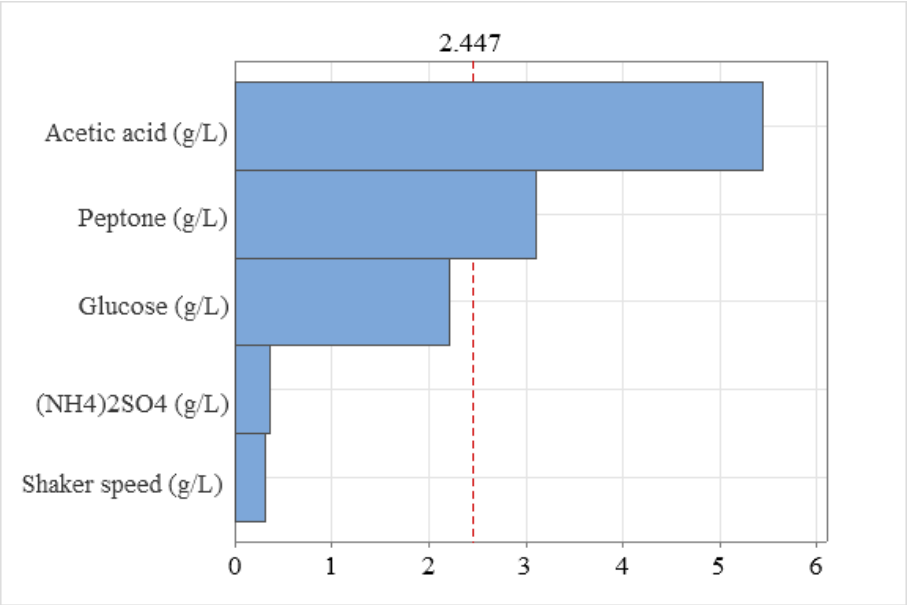


Figure S2. Standard effect Pareto chart of factor to response value.

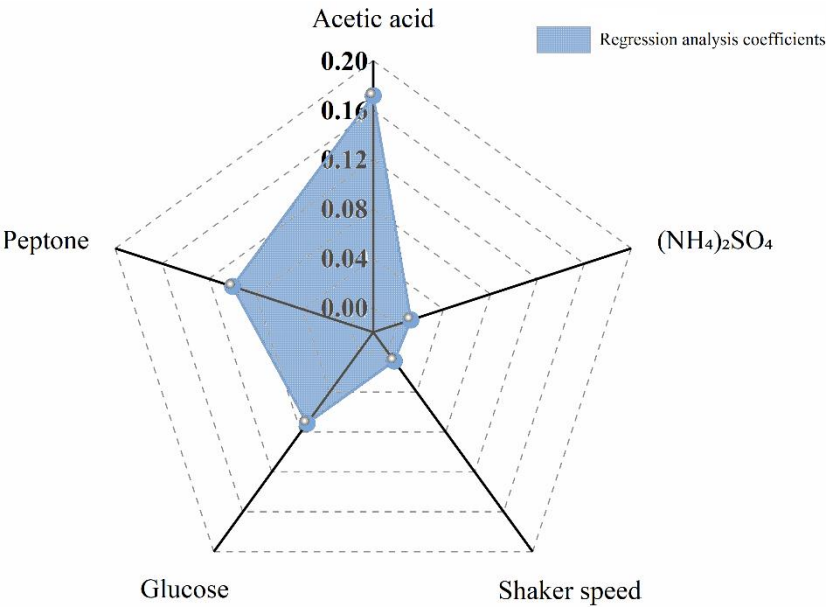


Figure S3. Comparison of regression coefficients of influencing factors.